

Remarks

Reconsideration of this application in light of the following remarks is respectfully requested. Claims 1, 2, 4-7 and 9-19 are pending in this application. The independent claims are Claims 1, 11, 18 and 19.

In one aspect (Claim 1), Applicants' invention as claimed is directed to an improvement in a method for the bleaching of chemical pulp, wherein the pulp is treated in a plurality of different steps and wherein at least in one step a bleaching solution which contains a peracid is used. The improvement claimed in the method is using the peracid in a post-bleaching which is the last step of the bleaching process, the post-bleaching taking place in the presence of one or several earth-alkali metal compounds, the pH of the post-bleaching solution is in the range of 3-8, and the kappa number of the pulp before the post-bleaching with a peracid is at maximum 4.

In another aspect (Claim 18), Applicants' invention as claimed is directed to a method for the bleaching of chemical pulp. The method comprises treating the pulp in a sequence of different steps at a bleaching plant, and finally in a post-bleaching step in a pulp flow pipe during transfer of the pulp, in a storage tower or at a paper mill outside the bleach plant. The post-bleaching is applied to a pulp having a kappa number at maximum 4 and comprises use of a bleaching solution containing peracid and having a pH within the range of 3-8, in the presence of one or several earth-alkali metal compounds. The peracid turns colorless chromophoric groups in the pulp.

In another aspect (Claim 19), Applicants' invention as claimed is directed to a method for the bleaching of chemical pulp. The method comprises treating the pulp in a

sequence of different steps at a bleach plant, transferring the treated pulp outside the bleaching plant and subjecting said treated pulp to a post-bleaching step outside the bleach plant in a pulp flow pipe during transfer of the pulp, in a storage tower or at a paper mill. The post-bleaching is applied to a pulp having a kappa number at maximum 4 and comprises use of a bleaching solution containing peracid and having a pH within the range of 3-8, in the presence of one or several earth-alkali metal compounds. The peracid turns colorless chromophoric groups in the pulp.

Post-bleaching is applied to pulp for which the delignification process proper in a bleach-plant is already finished. A high degree of delignification, a high brightness and a low kappa number are attained by Applicants' claimed method. The purpose of post-bleaching is to compensate for the decrease of brightness and thereby avoid the need of overbleaching in the delignification process. Overbleaching is disadvantageous because it results in a high consumption of chemicals. Post-bleaching is carried out outside the bleach plant in a pulp flow pipe or a storage tower or at a paper machine.

In Applicants' claimed method for the bleaching of chemical pulp, peracid is used in combination with at least one earth-alkali metal compound in the post-bleaching step that takes place outside of the bleach plant. The claimed method brings about an increase of brightness while the use of the earth-alkali metal compound effectively counteracts the adverse effect peracid alone would have on the viscosity and strength of the pulp. This has been shown in the working examples.

Claims 1, 2, 4-7 and 9-19 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite, as to the terms "post-bleaching step outside the bleach plant."

According to the Office Action, the claims include “treating the pulp with a peracid bleach solution” and “clearly such a step would be a bleaching step and by definition be part of a bleach plant” Office Action dated March 19, 2003, p. 2.

This rejection clearly does not apply to Claims 1, 2, 4-7 and 9-17 because those claims do not recite the terms “post-bleaching step outside the bleach plant.” Applicants assume that the rejection was intended to apply to Claims 18 and 19 which recite those terms. The rejection of Claims 1, 2, 4-7 and 9-17 under 35 U.S.C. §112, second paragraph, for indefiniteness for reciting terms that they do not recite is clearly in error and should be withdrawn.

As to Claims 18 and 19, the terms “post bleaching step outside the bleach plant” are clearly not indefinite to a person skilled in the art. A bleach plant is well known to a person skilled in the art. For example, U.S. Patent No. 5,632,859 to Heitto et al., (made of record by the Office Action here) describes various production sections located in separate buildings and connected with transfer pipings as the conventional arrangement of pulp mills, see column 7, line 23, or a bleaching plant, see column 8, line 49, among such production units or sections. Furthermore, Applicants’ Claims 18 and 19 define a pulp flow or transfer pipe, a storage tower or a paper mill as locations for the post bleaching, providing further clarification of the term “outside the bleach plant.” Heitto et al. describe transfer pipings (col. 1, lines 36-37) and a storage section (col. 7, line 23) as parts of a pulp mill that are separate from the bleaching plant. A paper mill, not mentioned by Heitto et al., is even more distinct from a bleaching plant, an entity separate from the entire pulp mill. Reading the post-bleaching locations claimed as part of the bleach plant is contrived and unreasonable. It misinterprets Claims 18 and 19 in a way that is completely at odds with the way a skilled person understands them. For these reasons, the rejection

of Claims 18 and 19 (as well as Claims 1, 2, 4-7 and 9-17) under 35 U.S.C. §112, second paragraph, as being indefinite, should be withdrawn.

Claims 1-2, 4-7 and 9-19 have been rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 3,865,685 to Hebbel et al. (“Hebbel ‘685”) or U.S. Patent No. 3,867,246 (“Hebbel ‘246”), in view of WO 97/45586 WO 94/20674 with or without U.S. Patent No. 4,222,819 to Fossum et al. Office Action dated March 19, 2003, p.2.

None of these references, alone or in combination, teach or suggest core features of Applicants’ invention, as exemplified by Method Claim 19.

- a bleaching sequence at a bleach plant,
- a further post-bleaching step to turn colorless chromophoric groups in the pulp,
- the post-bleaching taking place outside the bleach plant in a pulp flow pipe during pulp transfer, in a storage tower or in a paper mill,
- the pulp subjected to the post-bleaching step having a kappa a number of 4 or less,
- the post-bleaching being carried out with a peracid bleaching solution with a pH of 3-8
- one or more earth-alkali compounds present at the post-bleaching.

Hebbel ‘246 is newly cited and relied on in the Office Action dated March 19, 2003. Its teachings are quite similar to those of Hebbel ‘685 (previously relied on), but do not add anything new to Hebbel ‘685. Hebbel ‘246 describes using peracetic acid in the bleaching sequence of Example 1, but this is followed by an alkaline hydrogen peroxide bleach with 1% NaOH. In the rejection under 35 U.S.C. §103 of Claims 1, 2, 4-7 and 9-19, the Office Action

regularly refers to Hebbel '685 and Hebbel '246 in tandem, and to the extent they have been treated as a tandem by the Office Action, they are treated as such herein.

The primary references, Hebbel '685 or '246, are clearly deficient. Neither Hebbel '685 nor Hebbel '246 describe post-bleaching outside a bleach plant. They relate to integrated bleaching sequences for removal of lignin, and do not teach or suggest a kappa number 4 or less before the final stage. They do not disclose a final peracid step at a pH of 3-8. Instead, the final step uses peroxide and is highly alkaline. They refer to use of earth-alkali compounds only on a very general level, with no specific teaching of using them at a final peracid step. Moreover, the teaching of "complete" bleaching by Hebbel '685 or '246, if anything, teaches a skilled person away from post-bleaching according to the present invention.

The Office Action argues that Hebbel '685 or '246 teaches bleaching pulp in a 3-stage and 5-stage bleaching process (Example VIII) starting with a per compound, e.g., peracetic acid, and ending with a final (post-bleaching) per compound bleaching stage. Office Action dated March 19, 2003, p.2. However, the per compound that Hebbel '685 or '246 state is preferred and which they describe in the examples is hydrogen peroxide, not peracetic acid. Hebbel '685 or '246's teaching of bleaching with hydrogen peroxide in NaOH under strongly alkaline conditions does not teach or suggest Applicants' claimed method in which the final post-bleaching step is carried out with a peracid within a pH range of 3-8. Hebbel '685 or '246 teach a bleaching solution containing besides hydrogen peroxide also 1.0% of NaOH. Such a solution is strongly alkaline, having a pH well above 8. Hebbel '685 or '246, therefore, do not teach or suggest post-bleaching with peracid in acidic or neutral conditions, as specified by the claimed pH range of 3 to 8.

Even though Hebbel '685 or '246 uses hydrogen peroxide and not per acids in the examples, the Office Action argues that Hebbel '685 or '246 "further teach that a per acid could be used as the per compound, e.g., peracetic acid," and that "It would have been obvious to use the peracetic acid of Hebbel '685 or '246 as the per compound." Office Action dated March 19, 2003, pp. 2-3. Hebbel '685 or '246's inclusion of some per acids in a listing of per compounds (col. 2, lines 30-43) does not teach or suggest their use in a final bleaching step as a substitute for hydrogen peroxide. No competent chemist would consider using peracid instead of hydrogen peroxide for the final bleaching step because Hebbel '685 or '246 teach that such step is carried out under strong alkaline conditions. Peracid would require an acidic or neutral pH range, which would be contrary to the teachings of Hebbel '685 or '246 regarding their final bleaching stage. Hebbel '685 or '246 make a general teaching to having an alkaline final step at column 1, line 63, and exemplify such general teaching in their examples, wherein each time hydrogen peroxide is used for the final bleaching step, the conditions are strongly alkaline.

Moreover, Hebbel '685 or '246 state that "The amount of per compound added can be between 0.5 and 10 weight percent, preferably between 0.5 and 6 weight percent, calculated as 100 percent hydrogen peroxide and based on the oven dry calculated weight of the cellulose used." (column 2, lines 45-49). This does not teach or suggest using peracid in the post-bleaching step, for example, in an amount between 0.5 and 3 kg/tp as specifically claimed by Applicants in Claim 13. Applicants have surprisingly found that even when using "a very small peracetic acid dose, 0.5-3 kg/tp, the results of Applicants' method are obtained, and that larger doses are even detrimental. See Applicants' specification at page 4, lines 23-28.

The Office Action also argues that Hebbel '685 or '246 "further teaches that a

magnesium sulphate (alkaline earth compound) can be used as a complex builder or stabilizer.” Office Action dated March 19, 2003, p. 2. However, the disclosed use of an earth alkali metal compound in the bleaching process of Hebbel ‘685 or ‘246 is general and vague. There is no specific teaching of use of an earth alkali metal compound in a final peracid post-bleaching step, much less a teaching of such bleaching in neutral or acid conditions, applied to a pulp having a kappa number of 4 or less.

From the teaching that the first 4 stages of the bleaching process described in Example VII produce a pulp with a brightness over 90% MgO, the Office Action argues “It would have been obvious to the routineer that after the first 4 stages of [the bleaching process described in Example VIII of] HEBBEL ‘685 or ‘246 the brightness [of the pulp] would be above 85% ISO and [the pulp would have] a kappa number less than 4 as HEBBEL ‘685 or ‘246 teaches that after 4 stages the brightness is over 90% MgO.” Office Action dated March 19, 2003, p. 3. However, the Office Action’s argument that the first four stages would obviously produce a kappa number less than 4 is simply an unsupported assertion. The conclusions of the Office Action are based on the incorrect premise that the teachings of Examples VII and VIII of Hebbel ‘685 or ‘246 are properly combinable in the manner done by the Office Action. They are not. The first four stages of the bleaching process described in Example VIII of Hebbel ‘685 or ‘246 are markedly different from the first four stages of the bleaching process described in Example VII of Hebbel ‘685 or ‘246. Thus, they are not properly combinable in the manner in which the Office Action attempts to combine them.

Moreover, there is no description in either Example VII or VIII of Hebbel ‘685 or ‘246 of a bleaching process for pulp subjected to a final peracid post-bleaching step that produces

a pulp having a kappa number of 4 or less, (Claim 1), much less a final peracid post-bleaching step outside the bleach plant that produces a pulp having a kappa number of 4 or less (Claims 18 and 19). Neither Example VII or VIII of Hebbel '685 or '246 teaches or suggests a bleaching process as claimed by Applicants that produces a pulp having a kappa number of 4 or less.

Kappa number and brightness are two different parameters of pulp, which in principle do not depend on each other. Kappa number is a measure of the degree of delignification of a pulp, whereas brightness is merely a matter of its color. Even though a decreasing kappa number usually brings about an increasing brightness, there are other ways to increase brightness than delignification, and brightness can change with time. Consequently, brightness is not an adequate basis for gauging the kappa number with any certainty. Furthermore, Applicants' invention as claimed required that the kappa number of 4 or less has been reached before the final peracid post-bleaching step. There is no teaching or suggestion of such in Hebbel '685 or '246.

The Office Action further argues that "It would have been obvious to bleach the pulp at any point where pulp is normally bleached, e.g. flow pipe, storage tower or on the paper machine Office Action dated March 19, 2003, p.3. Post-bleaching in a flow pipe or storage tower, or on the paper machine are the subject matter of Claims 9-11 and 18-19. These are the specific locations for the post-bleaching according to Applicants' invention. Hebbel '685 or '246 does not refer to such separately performed final bleaching in any manner whatsoever. Rather, Hebbel '685 or '246 describe only bleaching that is performed in an ordinary bleach plant. Claims 9-11 and 18-19 in particular are remote from Hebbel '685 or '246, as well as the other references relied on in the Office Action. Applicants' invention improves post-bleaching

performed separately outside the sequential bleaching that is performed in an ordinary bleaching plant. Thus, it would not be obvious to modify the teachings of Hebbel '685 or '246 to bleach the pulp in a flow pipe, storage tower or on a paper machine without applying hindsight gleaned from Applicants' disclosure which is clearly improper.

As regards "complete" bleaching accordingly to Hebbel '685 or '246 and post-bleaching, the Office Action argues that Hebbel '685 or '246's process is a "complete" bleaching of cellulose that "does not require further teaching" and thus "the HEBBEL '685 or '246 would be a "post-bleach" stage as it comes after the other bleaching stages" Office Action dated March 19, 2003, p. 4. This argument only highlights the difference between Applicants' invention as claimed and the bleaching described by Hebbel '685 or '246 Hebbel '685 or '246's complete bleaching is a close sequence of subsequent steps typically performed at a bleach plant. Such a sequence achieves a high degree of delignification, that is a low kappa number, as well as a high brightness. Hebbel '685 or '246 teaches that nothing more needs to be done for the pulp. However, after such "complete" bleach, the brightness of the pulp may lower during storage, and post-bleaching is a measure taken to remedy this. Post-bleaching is typically carried out separately after the pulp has left the bleaching plant, and works by turning the pulp's chromophoric groups colorless rather than reducing the already very low residual lignin in the pulp. This is a clear difference from the cited references, which teach use of per compounds specifically for removing lignin from the pulp. See Applicants' specification at page 4, lines 13-21. Moreover, Claims 17-18 specifically recite that the peracid is used to turn colorless chromophoric groups in the pulp in the post-bleaching step and Claims 18 and 19 clearly recites that the post-bleaching step takes place outside of the bleach plant.

The teaching of the secondary references does not cure the above stated deficiencies of the primary references Hebbel '685 or '246. The Office Action argues that "WO 97/45586 teaches uses a pH of 4-8 in a peracid and chelating stage stabilizes the peracid," and thus, "It would have been obvious to use a pH of 4-8 to stabilize the peracid of HEBBEL '685 as taught by WO 97/45586." Office Action dated March 19, 2003, p. 3. This argument is misplaced. Although WO 97/45586 describes a peracid step in the pH range of 4-8, this step is not a post-bleaching step as there is always a subsequent alkaline step closing the bleaching sequence. According to the tables, the pH of the final alkaline step is within the range of 9-11. Considering that Hebbel '685 or '246's final peroxide step is always alkaline through the use of strong NaOH, there is nothing to suggest turning the final steps to the acidic or neutral pH range, i.e., to a pH of 8 or less.

The Office Action cites "WO 97/45586 as teaching that the pH after the peracetic acid stage is below 4, e.g., Table 2 shows final pH of 2.2 to 3.5 after peracetic acid bleach stage, and argues that "It would have been obvious to use the conditions of WO 97/95586, Table 2 to obtain low Kappa numbers from the dissolution of legnin." Office Action dated March 19, 2003, p.3.

However, WO 97/45586 nowhere applies peracid bleaching to pulp having a kappa number of 4 or less. The initial kappa numbers in WO 97/45586 are always higher, namely 4.9 or 5.6 according to tables 5 and 6. There are lower kappa numbers mentioned in the tables, but these are values resulting from the peracid step, and are not initial values. This does not teach or suggest Applicants' claimed invention as claimed in which the kappa number is required to be at maximum 4 before the final post-bleaching. Thus, WO 97/45586 does not

supply the deficiencies of Hebbel '685 or '246 and their combination does not teach or suggest Applicants' invention as claimed in Claims 1-2, 4-7 and 9-19.

WO 94/20674 also does not cure the deficiencies set forth above of Hebbel '685 or '246 (or of WO 97/45586). The Office Action relies on WO 94/20674 as teaching that "after a peroxide and peracid bleaching stage the Kappa number falls below 4," and argues "It would have been obvious that the Kappa number of the final peracetic acid bleach stage would be below 4 as it would have been lowered to such a value after the previous stages, see WO 94/20674, Tables on page 15." Office Action dated March 19, 2003, p. 3. This argument is erroneous. WO 94/20674 does not relate to post-bleaching outside a bleach plant. Moreover, the peracid stage relied upon by the Office Action is a delignification stage that brings the Kappa number below 4. It is not a post-bleaching stage as claimed in Applicants' claimed invention that is applied to pulp with a Kappa number already at 4 or less for turning chromophoric groups colorless.

Moreover, the combination of Hebbel '685 or '246 and WO 97/45586 or WO 94/20674 does not teach or suggest a bleaching process in which the amount of peracid used for post-bleaching is 0.5 to 3 kg/tp, as claimed by Applicants in Claim 13. For example, in WO 97/45586, the amount of peracid used for post-bleaching is always at least 5 kg/tp.

The Office Action apparently also relies on a sixth reference, U.S. Patent No. 5,632,859 to Heitto et al. in rejecting Claims 1, 2, 4-7 and 9-19 under 35 U.S.C. §103(a). While the rejection under 35 U.S.C. §103(a) does not list Heitto et al., at page 4 of the Office Action dated March 19, 2003, the Office Action presents an argument based on Heitto et al. that indicates Heitto et al. was intended to be part of the rejection under 35 U.S.C. §103(a) of Claims

1, 2, 4-7 and 9-19. Specifically, the Office Action relies on Heitto et al. as teaching “the alternativeness of putting all the process steps of a paper mill in a single plant or multiple plants,” and argues that “It would have been obvious that the post-bleaching stage could be in a separate building than the other bleach steps as taught by Heitto et al., column 1, lines 15-22.” (*Id.*, p. 4).

However, contrary to the Office Action’s argument, there is no description or suggestion in Heitto et al. of bleaching taking place in sections of the pulp mill other than the bleaching plant. There is no detailed description of the bleaching steps whatsoever. The Office Action’s argument that Heitto et al. would have rendered separate post-bleaching obvious is without basis in Heitto et al.

For these reasons, Applicants respectfully submit that Claims 1-2, 4-7 and 9-19 define patentable subject matter over the combined teachings of Hebbel ‘685 or ‘246 and WO 97/45586, WO 94/20674 (and Heitto et al.). The rejection of such claims under 35 U.S.C. §103(a) as obvious over Hebbel ‘685 or ‘246 in view of WO 97/45586 or WO 94/20674 should be withdrawn.

Claim 14 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Hebbel ‘685 or ‘246 in view of WO 97/45586 as applied to Claim 1, and further in view of U.S. Patent No. 4,222,819 to Fossum et al. The deficiencies of Hebbel ‘685 or Hebbel ‘246 and WO 97/45586 have been set forth above. Fossum et al. do not cure these deficiencies.

The Office Action relies on Fossum et al. as teaching “the alternativeness of using alkaline earth sulfates and carbonates as a complex builder (chelating agent) or stabilizer in per acid bleaching” and argues that “It would have been obvious to substitute the carbonate complex builder of FOSSUM et al. for the sulfate complex builder of HEBBEL ‘685 or ‘246 et al. as their

alternativeness is taught by FOSSUM et al.” Office Action dated March 19, 2003, p.4. The Office Action also argues that “It would have been obvious to use the calcium salt (calcium carbonate rather than the magnesium salt (Magnesium carbonate) as they are both alkaline earth metals and would be expected to be chemical equivalents. See HEBBEL ‘685 or ‘246 et al., column 3, line 34, for using calcium salts for the complex builder.” *Id.*, p.4.

Fossum et al. do not teach or suggest post-bleaching outside the bleach plant as claimed by Applicants. Nor do Fossum et al. describe a bleach sequence with a peracid final step as claimed by Applicants. Fossum et al.’s peracid step is always followed by an alkaline step for extraction of dissolvable lignin as the final step. There is no teaching or suggestion of treating a delignified pulp with a kappa number of 4 or less with peracid in order to turn chromophoric groups in the pulp colorless as claimed in Applicants’ invention. Accordingly, Fossum et al. do not cure the deficiencies of Hebbel ‘685 or ‘246 or WO 97/45586. The combination of Hebbel ‘685, Hebbel ‘246, WO 97/45586 and Fossum et al. does not teach or suggest Applicants’ Claim 14. The rejection applied to Claim 14 under 35 U.S.C. § 103(a) as unpatentable over Hebbel ‘685 or ‘246 in view of WO 97/45586 and Fossum et al. should be withdrawn.

Summary

For the reasons set forth herein, Claims 1, 2, 4-7 and 9-19 define patentable subject matter over the cited art, alone or in combination. An early allowance of Claims 1, 2, 4-7 and 9-19 is earnestly solicited.

Respectfully submitted,



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